

## PATENT ABSTRACTS OF JAPAN

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(54) OPTICAL DISK AND ITS MANUFACTURE

(57)Abstract:

PURPOSE: To attain a high density in an optical disk and high speed production of the optical disk without largely revising a series of process related to manufacture of an existing replica disk.

CONSTITUTION: A stamper 1 having a projecting part sticking a powder body is brought into contact with the surface of a transparent plate 3 of the optical disk, and the powder body is transferred on the surface of the transparent plate 3 to form a pit 2, to form a replica disk. Further, the optical disk has a reflection film 4 and a protection film 5 on the replica disk.

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## CLAIMS

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[Claim(s)]

[Claim 1] The optical disk characterized by forming a pit with the powder object which consists of the quality of the material from which the reflective film and a reflection factor differ.

[Claim 2] The optical disk according to claim 1 which formed said pit with carbon powder.

[Claim 3] The optical disk according to claim 2 which made particle size of said carbon powder 100-500A.

[Claim 4] The optical disk according to claim 1 which formed said pit with magnetic powder.

[Claim 5] The optical disk according to claim 1 which formed said pit with ferrous oxide.

[Claim 6] By being the approach of manufacturing the optical disk indicated in any 1 term of claims 1-5, making said powder object adhere to the projection part of La Stampa, and contacting this La Stampa on the transparence plate surface of an optical disk The manufacture approach of the optical disk characterized by creating the replica disk which imprinted said powder object on said transparence plate surface, and formed the pit, forming the reflective film on this replica disk further, and manufacturing an optical disk.

[Claim 7] While being the approach of manufacturing the optical disk indicated in any 1 term of claims 4-5, adding a field to La Stampa, making said magnetic powder stick to the projection part of said La Stampa and contacting this La Stampa on the transparence plate surface of an optical disk The manufacture approach of the optical disk to which it was presupposed that the replica disk which imprinted said magnetic powder on said transparence plate surface, and formed the pit by adding a field to a transparence plate is created, the reflective film is

further formed on this replica disk, and an optical disk is manufactured. [Claim 8] The manufacture approach of the optical disk according to claim 6 or 7 distributed by the binder with which said powder object contains an organic solvent.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the optical disk in which densification and high-speed creation are possible, and its manufacture approach especially about the optical disk which forms a pit by La Stampa which is original recording, and is manufactured, and its manufacture approach.

[0002]

[Description of the Prior Art] Progress of an information society in recent years increased the amount of the information which an organization and an individual treat picking, and data by leaps and bounds. The optical disk is developed as a memory medium for processing the information on such a huge amount, and data simply and quickly.

[0003] As compared with other memory media, such as a magnetic disk and a magnetic tape, recording density of an optical disk is high, it excels in a non-volatile, and information access can also be performed in a short time, and development and spread are progressing quickly from an extensive duplicate (manufacture of a replica disk) being easy. In current, the thing of the type according to an application is developed and the ROM medium mold only for playbacks, the postscript mold of a recordable type, the rewriting mold, etc. are used in every direction.

[0004] By creating the original recording which generally recorded the data called La Stampa, and manufacturing the replica disk in which the pit (hole) of concave or a groove was formed on the plate surface of the disk which consists of a synthetic-resin substrate etc., using this La Stampa, such an optical disk is reproduced in large quantities, and is offered.

[0005] Here, La Stampa used as the original recording of an optical disk is created by the following processes.

\*\* Apply a photoresist (photopolymer) to the glass disk used as original recording first, irradiate a laser beam spot with a diameter of a little

less than 1 micrometer from the mastering light source, rotating this, and carry out exposure record of the required information etc. Since an optical spot moves to radial with constant speed at this time, the spiral-like remains of exposure (latent image) are made on a disk (this pitch is usually about 1.6 micrometers).

\*\* Subsequently develop this. If negatives are developed, since the photoresist of the exposed part will begin to melt with a developer, the train (truck) of a concave convex pit is made on a disk plate surface. After vapor-depositing a metal to this, it reproduces and the state of impairment by the record condition, a blemish, etc. is checked.

\*\* At the end, nickel plating is performed to the done original recording, and La Stampa is completed.

[0006] Thus, information, data, etc. serve as concave convex, completed La Stampa is recorded, and a lot of replica disks are manufactured by approaches, such as plastic molding, by making this into original recording. Here, it is divided roughly into an injection-molding method and 2P (Photo-polymer) law as the manufacture approach of a replica disk by the difference in the formation approach of a pit.

[0007] Drawing 3 is the schematic diagram showing the method of producing the replica disk by injection molding widely used with the optical disk of mass-production nature. As shown in this drawing, the replica producing method by the injection-molding method Install La Stampa 1 in the metal mold which is not illustrated, and the plastic resin 10 (mainly polycarbonate) fused to this is poured in with an injection molding machine. Through the process of compression and cooling (condition shown in drawing 3 (a)), this is taken out from metal mold, and is produced, and the irregularity of La Stampa 1 is imprinted by the plastic plate as pit 10a as it is (refer to drawing 3 (b)).

[0008] On the other hand, 2P law, such as a diameter of large-sized and special use, as shown in production of the optical disk of a small amount lot at drawing 4 is used comparatively. This 2P law is an approach of arranging ultraviolet curing mold resin 20 between the transparence plate 3 and La Stampa 1, irradiating three persons by superposition (condition of drawing 4 (a)), and it irradiating this by the hardenability light source 30 from the transparence plate 3 side, stripping La Stampa 1 after resin hardens, and forming pit 20a.

[0009] That is, as shown in drawing 4 (a), what applied Photo-polymer (ultraviolet-rays hardening resin)20 to the transparent substrates 3, such as glass and plastics, is forced on La Stampa 1, ultraviolet rays are irradiated at this, resin is stiffened, and pit 20a is formed.

[0010] After that, according to each type of a disk, if it is postscript

/ rewriting mold and record film is a mold only for playbacks, the reflective film will be vapor-deposited, further, assemblies (disk-izing), such as a protective layer of transparence, are performed, and the replica disk which imprinted the pit train of original recording by these all directions methods turns into the last optical disk.

[0011] Each of these approaches is the approaches of imprinting the physical configuration of the irregularity currently formed in the La Stampa front face as it is, this irregularity is read according to the playback light source, and playback is performed. Such an optical disk is called a phase contrast playback disk, and when producing the same replica disk in large quantities, it is suitable. As a technique about the manufacture approach of the optical disk of such a phase contrast playback mold, the duplicate approach of the information record medium a publication is in the official report of JP, 62-287448, A.

[0012] By the way, the further densification and large capacity-ization are being required also in the optical disk with which such an optical disk is called high density and large capacity while reduction-izing of a manufacturing cost and manufacture at short time for delivery are demanded with rapid need increase in recent years. When it is going to treat image information especially, data will become huge and will be insufficient [ capacity ] in optical disks, such as 300MB (for example, 130mm postscript mold for information, a rewriting mold disk) of conventional one side, 540MB (compact disc) of one side, and 600MB (CD-ROM) of one side.

[0013] For this reason, although increase-ization of the capacity per disk one side is called for, in order to attain this, it is necessary to make thin width of face of the pit (or slot) itself formed, and to form many pits on a disk side. However, it was difficult to see physically, and for there to be a limitation in detailed-ization, and to cancel the lack of capacity because of the phase contrast playback mold which copies the irregularity of La Stampa as it is with the pit structure of the conventional optical disk mentioned above.

[0014] Then, in the official report of JP, 1-098142, A, the optical disk mastering equipment which exposes La Stampa using the light source which shortened wavelength using the nonlinear optical element is proposed in order to attain detailed-ization of the pit pattern formed on such an optical disk.

[0015] Moreover, in JP, 1-317241, A, the trouble of the conventional photofading \*\*\*\* is pointed out and the optical disk original recording creating method for attaining detailed-ization of a pit by putting this to a developer that it should improve from a process, before exposing a

photoresist film front face, and forming a refractory-ized layer in a front face is proposed.

[0016]

[Problem(s) to be Solved by the Invention] However, each technique given in each [ these ] official report followed the conventional approach as it was in principle, and since it was what is going to attain detailed-ization of a pit only from the process side, although management of the temperature in connection with exposure development and time amount etc. becomes severe, there was a problem that it could not respond in detailed-ization more than fixed.

[0017] In addition, the attempt of detailed-izing of the pit by short-wavelength-izing the mastering light source which performs exposure record to La Stampa which is original recording recently is made. By replacing this with the lights (for example, Ar:457.9nm etc.) mainly used as the mastering light source so far, and using UV light (for example, Ar363.8nm etc.) of short wavelength more It is what is going to form the detailed focusing beam spot. As an example of an announcement There are some which were announced in P38 of Joint International Symposium on Optical Memory and Optical Data Storage 1993 and Hawaii and P44 grade.

[0018] Not to mention the densification of a disk, the high density technique of such a reversion system is also indispensable. However, it is difficult to carry out from the point that enlargement of quality and a system etc. is needed, about short-wavelength-izing of the playback light source, and to carry the large-scale light source represented by gas laser as a matter of fact, and it is not realistic even if it sees from a cost side.

[0019] Although it is the high density technique of a reversion system similarly, this point and the optical system using the super resolution of light are small and a low price, and have many advantages of being able to use the light source with the high dependability from the former.

[0020] However, in order for there to be a problem that a surroundings lump of the side lobe of a signal invites degradation of a signal quality also to the optical system using the super resolution of this light and to have avoided this, the pinhole etc. needed to be prepared in front of the filter which separates a side lobe, or the detector.

[0021] Moreover, with optical disks, such as CD-ROM of the present condition reproduced using a phase which was mentioned above, even if it aimed at the dissolution of a side lobe such, since the disk itself has not necessarily resulted by the level which fully harnesses the reversion system of high density like the optical system by super

resolution, the improvement by the side of a disk is needed.

[0022] The configuration of the new disk media by the reflection and absorption which are not the phase contrast playback mold corresponding to the production process in which a high-speed imprint is more possible, and super resolution playback which replaces the press process of an optical disk which forms the conventional irregularity by advance of rapid high advancement in information technology of these days has come [ namely, ] to be called for.

[0023] This invention aims at offer of the optical disk in which densification and high-speed creation are possible, and its manufacture approach, without being proposed in order to solve the problem which such each conventional technique has, and adding a major change to a series of processes in connection with manufacture of the existing replica disk.

[0024]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the optical disk of this invention according to claim 1 is considered as the configuration which formed the pit with the powder object which consists of the quality of the material from which the reflective film and a reflection factor differ.

[0025] Moreover, the optical disk according to claim 2 is considered as the configuration which formed said pit with carbon powder.

[0026] Moreover, the optical disk according to claim 3 is considered as the configuration which made particle size of said carbon powder 100-500A.

[0027] Moreover, the optical disk according to claim 4 is considered as the configuration which formed said pit with magnetic powder.

[0028] Moreover, the optical disk according to claim 5 is considered as the configuration which formed said pit with the iron oxide.

[0029] Moreover, the manufacture approach of an optical disk according to claim 6 By being the manufacture approach of the optical disk indicated in any 1 term of claims 1-5, making said powder object adhere to the projection part of La Stampa, and contacting this La Stampa on the transparence plate surface of an optical disk The replica disk which imprinted said powder object on said transparence plate surface, and formed the pit is created, and it has considered as the manufacture approach of the optical disk in which the reflective film was formed on this replica disk, further.

[0030] Moreover, the manufacture approach of an optical disk according to claim 7 While being the manufacture approach of the optical disk indicated in any 1 term of claims 4-5, adding a field to La Stampa,

making said magnetic powder stick to the projection part of said La Stampa and contacting this La Stampa on the transporence plate surface of an optical disk By adding a field to a transporence plate, the replica disk which imprinted said magnetic powder on said transporence plate surface, and formed the pit is created, and it has considered as the manufacture approach of the optical disk in which the reflective film was formed on this replica disk, further.

[0031] Furthermore, the manufacture approach of an optical disk according to claim 8 is the manufacture approach of an optical disk according to claim 6 or 7, and is considered as the manufacture approach of the optical disk distributed by the binder with which said powder object contains an organic solvent.

[0032]

[Function] Since a replica disk is created by making powder, such as not physical irregularity but carbon, and ferrous oxide, a pit adhere on the plate surface of an optical disk according to the optical disk and its manufacture approach of this invention which consists of the above-mentioned configuration, while higher-density record is attained, a replica disk can be manufactured more at high speed.

[0033]

[Example] Hereafter, the optical disk of this invention and the first example of the manufacture approach are explained with reference to a drawing. Drawing 1 is the schematic diagram showing each process of each component for enforcing the manufacture approach concerning this example, and this manufacture approach.

[0034] First, each component for enforcing the manufacture approach in this example is explained, referring to drawing 1. In this drawing, 1 is La Stampa as the master which carried out nickel plating of the original recording which recorded information, data, etc., and created it, or a mother. In addition, it is created about creation of La Stampa by the same process as the conventional approach mentioned above.

[0035] In this example, carbon powder constitutes 2, each projection part of La Stampa 1 adheres to it, it is that La Stampa 1 is stuck to the transporence plate 3 by pressure, and it is a pit and it is imprinted [ it is contacted and ] by the front face of the transporence plate 3.

[0036] Here, as a particle size of the carbon powder which constitutes this pit 2, generally, since there is a possibility that idea \*\* may condense in the case of the carbon powder of particle size detailed to remainder, and equalization cannot be attained on the contrary when better, as fine (for example, 1000A), an about 100-500A thing is



desirable.

[0037] The transparence plate 3 which constitutes an optical disk is usually formed according to the quality of the materials, such as a polycarbonate, glass or polyolefine, and an acrylic. Moreover, as for the reflective film 4 formed on a pit, an aluminium alloy is usually used. Furthermore, as a protective layer 5 formed on the reflective film 4, the ultraviolet-rays hardening resin of an acrylate system or an urethane system is used.

[0038] Next, the manufacture approach of the optical disk of this example is explained with reference to drawing 1. By making completed La Stampa 1 into a master or a mother, the optical disk concerning this example is the following, and is made and created. First, carbon powder is made to apply and adhere to the front face of each projection part of La Stampa 1.

[0039] In this case, when the binder containing an organic solvent is made to distribute carbon powder if needed, adhesion in La Stampa 1 is equalized and it is more desirable. In this condition, La Stampa 1 is stuck to the transparence plate 3 by pressure, and is contacted, carbon powder is imprinted on the transparence plate 3, and a pit 3 is formed on the front face of the transparence plate 3.

[0040] Then, on the front face of the transparence plate 3 in which the pit was formed with carbon powder, like the manufacture approach of the conventional optical disk mentioned above, while forming the reflective film 4 by the aluminium alloy by sputtering, in order to protect a pit side, it disk-izes by applying the protective layer 5 which consists of ultraviolet curing mold resin in a spin coater, and making it harden in ultraviolet rays. Moreover, label printing of a title etc. is also performed on the front face of a protective layer 5 if needed.

[0041] Thus, the optical disk with which the pit was formed becomes reproducible by difference of contrast with the pit which consists of the reflective film and carbon powder on a disk, such as aluminum, i.e., the reflection factor of the reflective film and a pit, without being based on the phase contrast by the shape of physical toothing like the conventional optical disk.

[0042] Thus, since according to the manufacture approach of this example a pit is formed by making not physical irregularity but powder adhere, without changing the production process of the conventional optical disk while being able to create a replica disk more at high speed as compared with the conventional optical disk, higher-density record is attained.

[0043] Moreover, since a pit is not based on concavo-convex structure, conventionally, a surroundings lump of the side lobe by the phase pit

which had become a problem at the time of playback by super resolution can also be canceled, and it becomes possible to use the conventional light source as it is. Therefore, as compared with using the source of short wave Nagamitsu, low-pricing of the light source itself can be attained, and problems, such as a fall of the sensibility accompanying short-wavelength-izing of a detection detector, are also lost.

[0044] Next, the optical disk of this invention and the second example of the manufacture approach are explained with reference to drawing 2 . Drawing 2 is the schematic diagram showing each process of each component for enforcing the manufacture approach concerning this example, and this manufacture approach. As shown in this drawing, in order to perform the imprint stuck from the transparence plate of a pit in this example, the approach using magnetic powder and an electromagnet is adopted on the occasion of pit formation.

[0045] Generally, although detailed powder has the inclination for it to condense and to solidify greatly and there is a distributed technique to a binder etc. as a means to prevent this, this is a field with much know-how, and has particulars in a manufacturing technology. However, about magnetic powder, especially an iron oxide ( $\text{Fe}_2\text{O}_3$  and gamma hematite  $\text{Fe}_3\text{O}_4$ ), the means of equalization is established comparatively for many years, and it is used in the field of the high polymer film centering on polyester etc.

[0046] For example, as a distributed technique in a magnetic tape, without making a minute iron oxide 1 micrometer or less condense, it is stabilized industrially, is made to distribute and the process which applies a record ingredient to homogeneity on the high polymer film represented by polyester is performed.

[0047] In this example, the technique of equalization of such magnetic powder is applied to pit formation. As shown in drawing 2 , to namely, La Stampa 1 which consists of nickel which is a ferromagnetic Give a field through an electromagnet 4, and while making pit 2a formed with the equalized magnetic powder stick to the La Stampa 1 side once (condition of drawing 2 (a)) and giving a field through an electromagnet 5 after that from the transparence plate 3 side It is the approach which demagnetizes La Stampa 1, and draws near pit 2a which consists of magnetic powder on La Stampa 1, and the front face of the transparence plate 3 is made to imprint (condition of drawing 2 (b)).

[0048] Since the nickel which forms La Stampa 1 is a ferromagnetic, formation of pit 2a by adhesion of magnetic fine particles is closed by making the binder which is not illustrated through an electromagnet 6 distributed [ magnetic fine-particles ] stick to the La Stampa height,

forcing on the transparence plate 3 after that the magnetic fine particles which have adhered at the tip of a height of La Stampa 1, and imprinting with an electromagnet 7 from hard flow, if .

[0049] Thereby, uniform magnetic fine particles are imprinted by the transparence plate 3 as pit 2a. About the reflective film after an imprint, and formation of a protective layer, it carries out like said first example.

[0050] In addition, about La Stampa 1, it is more desirable in the creation process to create about 300-micrometer nickel alloy film, and to process this for an inside-and-outside periphery, a rear face, etc. according to the plating process which forms the nickel electric conduction film with vacuum thin film creation techniques, such as a spatter, after exposure, and is called a electrocasting process.

[0051] Thus, according to the manufacture approach of the optical disk of this example, pit formation can be ensured [ at high speed and ] as compared with the first example mentioned above.

[0052]

[Effect of the Invention] The densification of an optical disk and high-speed creation are attained without performing a major change about a series of processes in connection with the production process of the existing optical disk according to the optical disk and its manufacture approach of this invention, as explained above.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the schematic diagram showing each process of each component for enforcing the manufacture approach of the optical disk concerning the first example of this invention, and its manufacture approach.

[Drawing 2] It is the schematic diagram showing each process of each component for enforcing the manufacture approach of the optical disk concerning the second example of this invention, and its manufacture approach.

[Drawing 3] It is the schematic diagram showing each process of each component for enforcing the manufacture approach of the conventional optical disk, and its manufacture approach.

[Drawing 4] It is the schematic diagram showing each process of each

component for enforcing other manufacture approaches of the conventional optical disk, and its manufacture approach.

[Description of Notations]

- 1 -- La Stampa
  - 2 -- Pit
  - 2a -- Pit
  - 3 -- Transparence plate
  - 4 -- Reflective film
  - 5 -- Protective layer
  - 6 -- Electromagnet
  - 7 -- Electromagnet
  - 10 -- Plastic resin
  - 20 -- Ultraviolet-rays hardening resin
  - 30 -- Hardenability light source
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